



Biological Assessment Study Report

Big Creek Harrison County

October 2014 – March 2015

Prepared for:

Missouri Department of Natural Resources
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1.0 Introduction

At the request of the Missouri Department of Natural Resources (**Department**) Water Protection Program (**WPP**), the Environmental Services Program (**ESP**), Water Quality Monitoring Section (**WQMS**) conducted a biological assessment of Big Creek (WBID 0444). Big Creek is located in the Central Plains/Grand/Chariton Ecological Drainage Unit (**EDU**) and originates in the southwest corner of Bethany, Missouri, in Harrison County. Raissa Espejo, Mike Irwin, Dave Michaelson, and Carl Wakefield conducted the field portion of this study.

Water quality studies conducted by Department staff in 2003 documented high levels of ammonia ($\text{NH}_3\text{-N}$) and low levels of dissolved oxygen in samples collected downstream of the Bethany Wastewater Treatment Facility outfall (**WWTF**, permit #MO0033502) (MoDNR 2015b). The 2004-2006 303(d) List of Impaired Waters listed 22 miles of Big Creek as impaired for $\text{NH}_3\text{-N}$ and dissolved oxygen. The 2014 303(d) list narrowed the listed reach to 1.0 miles for $\text{NH}_3\text{-N}$ and 6.1 miles for dissolved oxygen. Both 303(d) lists (and all in between) attributed the source of impairment to the Bethany WWTF. In 2015, however, the Department recommended that Big Creek be removed from the 303(d) list based on macroinvertebrate samples collected in fall 2014. In addition, water samples collected in 2010 and 2014 showed that dissolved oxygen and $\text{NH}_3\text{-N}$ concentrations were no longer in violation of Missouri's Water Quality Standards (**WQS**; MoDNR 2014). The U.S. EPA concurred with this assessment, which led to the delisting of Big Creek on August 7, 2015.

1.1 Purpose

The purpose of this study was to determine the present condition of the Big Creek macroinvertebrate community, water quality, and stream habitat.

1.2 Objectives

- 1) Determine if the macroinvertebrate community of Big Creek is impaired compared to biological criteria developed from reference stream data in the Central Plains/Grand/Chariton EDU.
- 2) Assess the habitat quality of Big Creek.
- 3) Determine if the water quality of Big Creek is impaired compared to Missouri's WQS (MoDNR 2014).

1.3 Tasks

- 1) Conduct a biological assessment of the macroinvertebrate community of Big Creek at five sampling stations during the fall 2014 and spring 2015 sampling seasons.
- 2) Conduct a habitat assessment of Big Creek sampling stations to ensure comparability of aquatic habitats compared to reference conditions.

- 3) Collect water samples and water quality field measurements of five Big Creek stations during the fall 2014 and spring 2015 sampling seasons.

1.4 Null Hypotheses

- 1) Macroinvertebrate assemblages in Big Creek samples will be similar to the Central Plains/Grand/Chariton EDU Wadeable/perennial stream biological criteria.
- 2) Macroinvertebrate assemblages will not differ among longitudinally separate Big Creek stream segments.
- 3) Physicochemical water quality from Big Creek samples will meet Missouri's WQS (MoDNR 2014).
- 4) Physicochemical water quality will not differ among longitudinally separate reaches of Big Creek.
- 5) Habitat quality will be similar among Big Creek stream segments.
- 6) Habitat quality will be similar between Big Creek and biocriteria reference streams.

2.0 Study Area

Big Creek, a tributary of the Grand River, originates in southwestern Bethany, Missouri, at the confluence of the West Fork Big Creek and East Fork Big Creek (Figure 1). Big Creek is designated as a class "P" stream for 31.5 miles with designated beneficial uses of "warm water aquatic life protection, human health/fish consumption, livestock and wildlife watering, whole body contact "B" and drinking water supply" (MoDNR 2014).

Big Creek is located within the Central Plains/Grand/Chariton Ecological Drainage Unit (EDU). An EDU is a region in which biological communities and habitat conditions can be expected to be similar.

2.1 Station Descriptions

A total of five sampling locations were selected for this study. All sample stations were located in Harrison County (Figure 2).

Big Creek Station #1 (NE 1/4 SW 1/4 sec. 21, T. 62 N., R. 28 W.) was located downstream of Highway AA. Geographic coordinates were UTM zone 15, Easting 409551, and Northing 4445623.

Big Creek Station #2 (NE 1/4 NW 1/4 sec. 05, T. 62 N., R. 28 W.) was located downstream of Highway 69. Geographic coordinates were UTM zone 15, Easting 408355, and Northing 4451101.

Big Creek Station #3 (NE 1/4 NE 1/4 sec. 29, T. 63 N., R. 28 W.) was located west of Highway 69 where the creek is within approximately 150 feet of the road. Geographic coordinates were UTM zone 15, Easting 409092, and Northing 4454150.

Big Creek Station #4 (SE 1/4 SE 1/4 sec. 17, T. 63 N., R. 28 W.) was located downstream of the Bethany WWTP. Geographic coordinates were UTM zone 15, Easting 409506, and Northing 4456469.

Big Creek Station #5 (NE 1/4 SW 1/4 sec. 16, T. 63 N., R. 28 W.) was located upstream of the Bethany WWTP. Geographic coordinates were UTM zone 15, Easting 409711, and Northing 4456632.

2.2 Study Timing

Macroinvertebrate and water samples were collected at the Big Creek stations during the fall 2014 and spring 2015 sampling seasons. Fall sampling was conducted on October 21, 2014, and spring sampling was conducted on March 18-19, 2015. Habitat assessment of Big Creek was conducted on August 27, 2014.

3.0 Methods

3.1 Land Cover

Land cover percentages were determined using the Missouri portion of the MoRAP Thematic Mapper satellite data from 2000 to 2004. Land cover percentages were determined for the entire Central Plains/Grand/Chariton EDU and the Big Creek test stations.

3.2 Quality Assurance/Quality Control (QA/QC)

3.2.1 Field Meters

All field meters used to collect water quality parameters were maintained in accordance with *Quality Control Procedures for Checking Water Quality Field Instruments* (MoDNR 2016g).

3.2.2 Biological Samples

Steps to assure accuracy of organism removal from sample debris were performed consistent with those methods found in the *Semi-Quantitative Macroinvertebrate Stream Bioassessment Project Procedure (SMSBPP)* document (MoDNR 2012).

Macroinvertebrates found in samples were identified to the taxonomic levels found in *Taxonomic Levels for Macroinvertebrate Identification* (MoDNR 2016k).

3.2.3 Biological Data Entry

All macroinvertebrate data were entered into the WQMS macroinvertebrate database consistent with *Quality Control Procedures for Data Processing* (MoDNR 2016h).

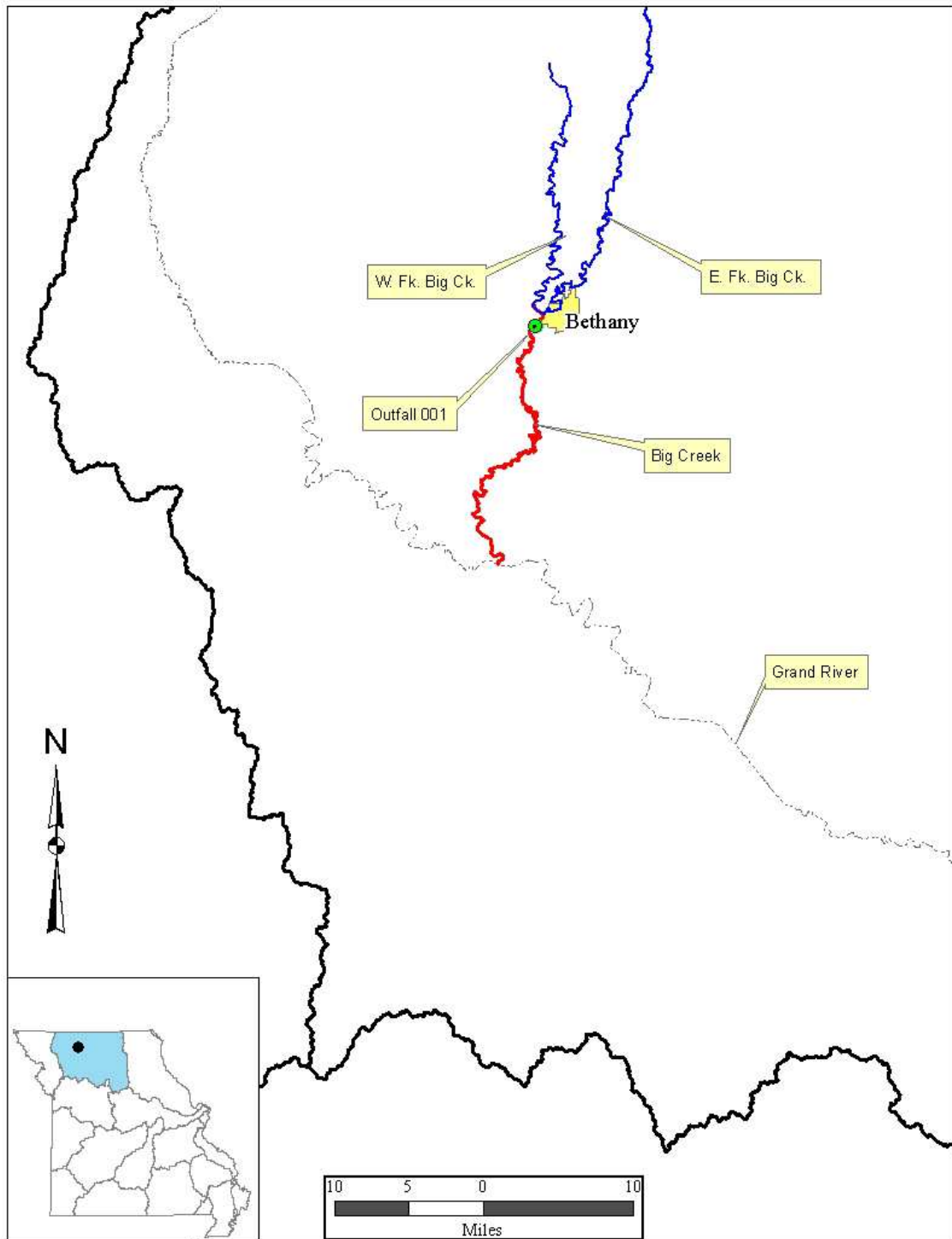


Figure 1. Big Creek (WBID 0444) in the Central Plains/Grand/Chariton EDU (formerly impaired reach in red).

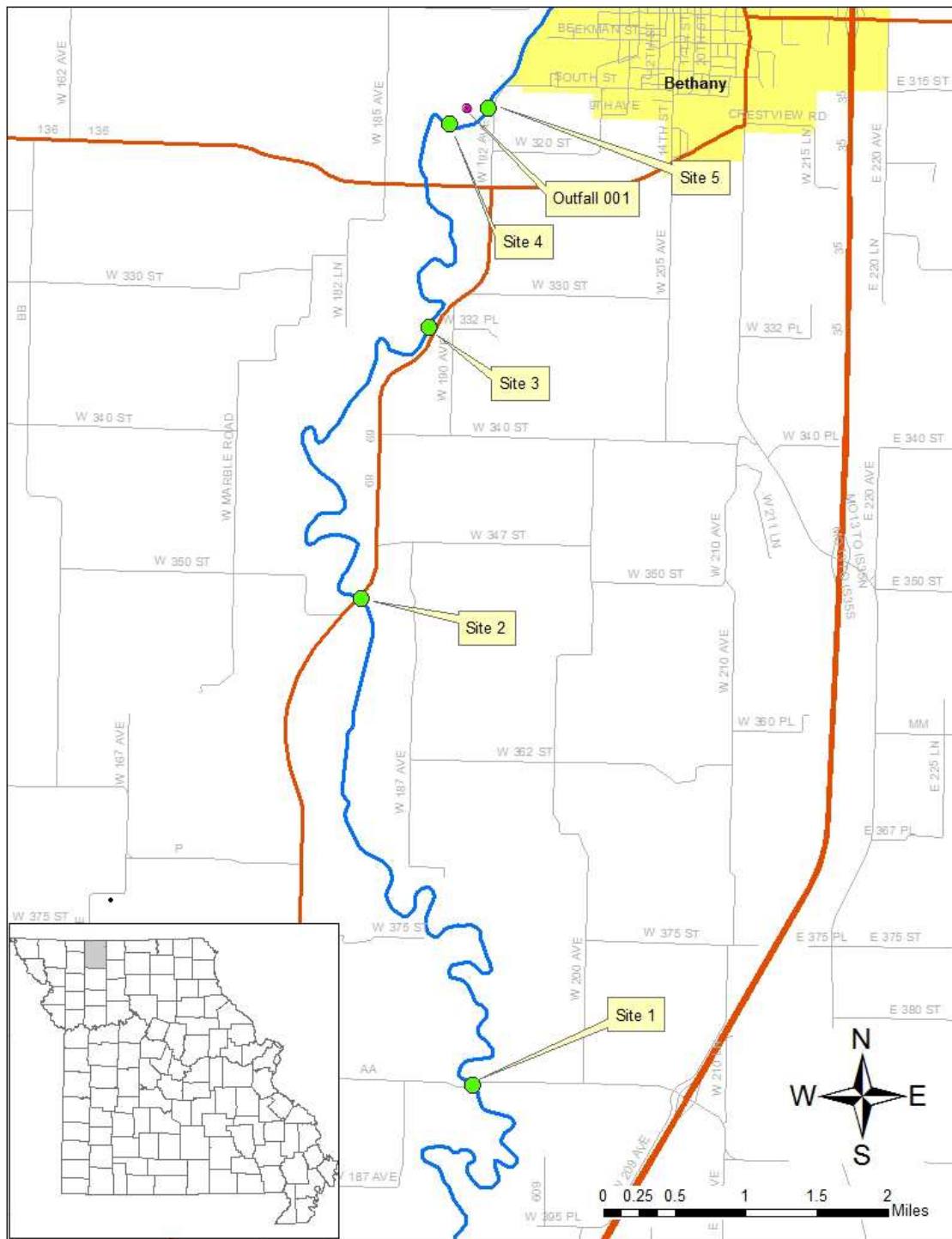


Figure 2. Big Creek Fall 2014 and Spring 2015 Sampling Stations, Harrison County.

3.2.4 Duplicate Sample Collection

Duplicate samples are collected at two randomly selected sampling stations per season for macroinvertebrates and for 10 percent of water samples. Duplicate water samples were collected in spring 2015 at Station 5, but duplicate macroinvertebrate sampling was not conducted during this study. All water quality parameters were within acceptable relative percent difference values.

3.3 Habitat Assessment

A standardized habitat procedure for riffle/pool stream types was followed in the *Stream Habitat Assessment Project Procedure (SHAPP)* (MoDNR 2016j). A habitat assessment was conducted at the five Big Creek test stations and at the West Fork Big Creek Biological Criteria Reference (**BIOREF**) station, which is also located in Harrison County approximately 10 miles north of Bethany. All habitat assessments were conducted on August 27, 2014. Habitat scores of Big Creek were then compared with the habitat score of West Fork Big Creek.

3.4 Macroinvertebrate Collection and Analysis

Macroinvertebrate sampling was conducted as described in the SMSBPP (MoDNR 2012). Big Creek is considered a glide/pool dominated stream. Three standard habitats, non-flowing water with depositional substrate (**NF**), large woody debris (known also as snag habitat = **SG**), and rootmat (**RM**) at the stream edge, were sampled at all locations.

Macroinvertebrate data were analyzed using two methods. The first analysis was to calculate the Macroinvertebrate Stream Condition Index (**MSCI**) using the four general biological metrics found in the SMSBPP (MoDNR 2002, MoDNR 2012). These four biological metrics included: 1) Taxa Richness (**TR**); 2) Ephemeroptera/Plecoptera/Trichoptera Taxa (**EPTT**); 3) Biotic Index (**BI**); and 4) Shannon Diversity Index (**SDI**). These individual metrics were scored by comparing them to the biological criteria for perennial/wadeable streams from the Central Plains/Grand/Chariton EDU and combined to form the MSCI. MSCI scores of 16-20 qualify as fully supporting, 10-14 are partially supporting, and 4-8 are considered non-supporting of the protection of warm water aquatic life beneficial use designation as specified in the Missouri WQS (MoDNR 2014).

3.5 Physicochemical Data Collection and Analysis

3.5.1 *In situ* Water Quality Measurements

During each survey period, *in situ* water quality measurements were collected at all stations for temperature (°C) (MoDNR 2016e), dissolved oxygen concentration (mg/L) (MoDNR 2016b), specific conductance (µS/cm) (MoDNR 2016c), and pH (MoDNR 2016d).

3.5.2 Water Chemistry

Surface-water grab samples were collected and returned for analyses to ESP. Turbidity (NTU) (MoDNR 2016a) was measured and recorded in the ESP WQMS biology laboratory. Water samples were analyzed by ESP's Chemical Analysis Section for total

suspended solids, chloride, sulfate, total calcium, total magnesium, total phosphorus (TP), ammonia-N (NH₃-N), nitrate+nitrite-N (NO₃+NO₂-N), and total nitrogen (TN). Procedures outlined in *Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations* (MoDNR 2016i) and *Field Sheet and Chain-of-Custody Record* (MoDNR 2016f) were followed when collecting water quality samples. Stream velocity was measured at each station using a SonTek/YSI FlowTracker Handheld-ADV (Acoustic Doppler Velocimeter). Discharge was calculated per the methods in *Flow Measurement in Open Channels* (MoDNR 2015a).

3.5.3 Data Analysis

Physicochemical data were examined by analyte to determine whether stations had violations of the Missouri WQS. Sampling stations that had values not in compliance with the WQS or U.S. Environmental Protection Agency (USEPA) recommended reference values are discussed in the report with possible influences being identified.

4.0 Data Results

4.1 Land Use

The land use data in Table 1 provides a comparison between the 12-digit hydrological units covered within the study reach of Big Creek and the Central Plains/Grand/Chariton EDU. Big Creek stations 2-5 all were in the same hydrologic unit, which resulted in identical land use percentages among sites. These stations had similar land use percentages compared to the EDU. Station 1 differed by having more cropland and less grassland than the remaining stations upstream.

Table 1
 Percent Land Cover

Stations	12-digit HUC	Urban	Cropland	Grassland	Forest	Wetland	Open Water
Central Plains/ Grand/Chariton Drainages EDU	N/A	2.5	28.3	45.2	18.6	3.7	1.6
Big Creek Station #1	102801010911	2.2	45.6	32.4	14.1	3.8	1.9
Big Creek Stations #2-5	102801010910	3.5	33.2	44.1	15.4	1.9	1.9

4.2 Habitat Assessment

Habitat assessment scores were recorded for each sampling station. All Big Creek stations exceeded the 75% threshold; therefore, based on habitat scores, they should support a biological community that is similar to reference conditions. The stream habitat assessment categories and the results of the stream assessment at each station are presented in Tables 2 and 3. Habitat scores for the Big Creek stations were compared to West Fork Big Creek, a BIOREF station.

Table 2
Habitat Assessment Categories

Comparable to Reference	≥90%
Supporting	75-89%
Partially Supporting	60-74%
Non-supporting	<59%

Big Creek is a glide/pool stream, with sand being the dominant benthic substrate. Epifaunal substrate was in the marginal or poor category among all stations, including the BIOREF site. Sediment deposition scores were identical among all stations, with all sites scoring in the poor category. All stations had ≥90 percent sediment deposition; however, this value was similar to the reference stream (89 percent deposition). No obvious evidence of channelization was observed at any of the stations. Although most stations had a good riparian corridor in the optimal category, vegetative protection was minimal. No stations had more than 26 percent vegetative coverage, and both banks of all stations (including the BIOREF) ranked in the poor category. Despite the lack of vegetative cover among stations, bank stability was in the optimal or suboptimal category for both banks at all but Stations 4 and 5. Channel flow status, which is a measure of the amount of water present in the stream channel, was in the suboptimal category for all Big Creek sites, with the exception of Station 3, which was marginal. Water filled roughly 80 to 95 percent of the stream channel, and less than a quarter of the channel substrate was visible above the surface of the water. Pool variability ranged from optimal at Station 4 to marginal at Stations 2, 3, 5, and the BIOREF site. This parameter is a measure of the diversity of pool habitats in a sample reach based on pool size and depth that is used to observe whether habitat complexity may be a factor in macroinvertebrate community attributes.

4.3 Biological Assessment

Based on biological metric threshold values calculated for the Central Plains/Grand/Chariton EDU, all five Big Creek stations attained fully supporting status for both fall and spring sampling seasons. During both seasons, all Big Creek sites attained the highest possible MSCI score of 20, with the exception of Station 4, which had an MSCI score of 18 in spring 2015.

All Big Creek biological metric values exceeded their respective optimal thresholds except EPT taxa at Station 4, which tied the threshold value of eight. As a result, all individual metrics achieved scores of five except the Station 4 EPTT score of three. Biological metric values and their scores, as well as the Central Plains/Grand Chariton EDU threshold ranges, are presented in Tables 4 and 5 for the fall and spring sample seasons, respectively.

Table 3
Total Stream Habitat Assessment Scores, Individual Parameter Categories and Scores,
and Percent Comparison with the West Fork Big Creek Biological Criteria Reference
Station

Stream Habitat Parameters	Big Creek Stations					BIOREF
	1	2	3	4	5	W. Fk. Big Cr.
Macroinvertebrate Sample Number	14949	14950	14951	14952	14953	--
Epifaunal Substrate/Available Cover	III (7)	III (7)	IV (3)	III (6)	IV (2)	IV (4)
Pool Substrate Characterization	II (15)	II (15)	II (15)	II (15)	II (15)	I (16)
Pool Variability	II (14)	III (10)	III (10)	I (16)	III (10)	III (10)
Sediment Deposition	IV (3)	IV (3)	IV (3)	IV (3)	IV (3)	IV (3)
Channel Flow Status	II (13)	II (13)	III (15)	II (12)	II (12)	II (14)
Channel Alteration	I (20)	I (20)	I (20)	I (20)	I (20)	I (20)
Channel Sinuosity	III (6)	III (8)	III (7)	III (6)	III (6)	IV (5)
Bank Stability – Left Bank	I (9)	I (10)	I (10)	IV (2)	I (10)	I (10)
Bank Stability – Right Bank	I (9)	I (10)	II (7)	I (10)	III (4)	I (10)
Vegetative Protection – Left Bank	IV (2)	IV (1)	IV (1)	IV (1)	IV (1)	IV (2)
Vegetative Protection – Right Bank	IV (1)	IV (1)	IV (1)	IV (1)	IV (1)	IV (1)
Riparian Zone Width – Left Bank	I (10)	IV (2)	III (5)	I (9)	I (10)	I (10)
Riparian Zone Width – Right Bank	I (9)	I (10)	I (10)	I (10)	I (9)	IV (2)
Total Habitat Score	118	110	107	111	103	107
Percent of BIORREF SHAPP	>100	>100	100	>100	96	--

Habitat parameter categories range from I to IV with category I = optimal, category II = suboptimal, category III = marginal, and category IV = poor. Habitat parameter scores are listed in parentheses and range from 0 to 20 except for vegetative protection and riparian zone categories, which range from 0 to 10.

Although few biological metric differences existed among stations within sampling seasons, there were notable differences when comparing fall versus spring (Tables 4 and 5). Each of the Big Creek stations had lower TR and EPTT values in spring samples. Station 4 was the only site to have a sufficiently reduced number of EPTT to result in a lower score for that metric, however. Whereas Station 4 had 20 EPTT in the fall, there were only eight in the spring. Station 4 also had the largest decline in TR from fall (TR=80) to spring (TR=59). Despite this reduction of 21 taxa, the spring TR value was above the optimal threshold value. Station 5 exhibited the smallest decline in TR from fall (TR=65) to spring (TR=63). Variation among the remaining biological metrics was slight. Biotic index values were similar among seasons and stations, but Stations #3 and #4 each had slightly higher values than the remaining stations during both seasons. Although slight differences in SDI values existed among stations in both seasons, there did not appear to be a pattern.

Table 4
 Fall 2014 Big Creek Macroinvertebrate Stream Condition Index (MSCI) Scores and
 Biological Criteria for Warm Water Reference Streams in the Central Plains/
 Grand/Chariton EDU

Stations	Sample #	TR	EPTT	BI	SDI	MSCI	Support
Big Cr. #1	14949	69 (5)	19 (5)	6.2 (5)	3.35 (5)	20	Full
Big Cr. #2	14950	67 (5)	22 (5)	6.0 (5)	2.98 (5)	20	Full
Big Cr. #3	14951	75 (5)	24 (5)	6.6 (5)	3.21 (5)	20	Full
Big Cr. #4	14952	80 (5)	20 (5)	6.5 (5)	3.12 (5)	20	Full
Big Cr. #5	14953	65 (5)	21 (5)	6.3 (5)	2.98 (5)	20	Full
BIOREF Score=5	----	>51	>9	<7.2	>2.69	20-16	Full
BIOREF Score=3	----	51-25	9-5	7.2-8.6	2.69-1.35	14-10	Partial
BIOREF Score=1	----	<25	<5	>8.6	<1.35	8-4	Non

MSCI scoring range calculated using Central Plains/Grand/Chariton EDU BIOREF samples ($n=20$).

Table 5
 Spring 2015 Big Creek Macroinvertebrate Stream Condition Index (MSCI) Scores and
 Biological Criteria for Warm Water Reference Streams in the Central Plains/
 Grand/Chariton EDU

Stations	Sample #	TR	EPTT	BI	SDI	MSCI	Support
Big Cr. #1	15093	59 (5)	15 (5)	6.5 (5)	2.87 (5)	20	Full
Big Cr. #2	15094	53 (5)	12 (5)	6.5 (5)	2.74 (5)	20	Full
Big Cr. #3	15095	69 (5)	12 (5)	7.2 (5)	3.30 (5)	20	Full
Big Cr. #4	15096	59 (5)	8 (3)	6.7 (5)	2.80 (5)	18	Full
Big Cr. #5	15097	63 (5)	13 (5)	6.6 (5)	2.91 (5)	20	Full
BIOREF Score=5	----	>50	>8	<7.3	>2.51	20-16	Full
BIOREF Score=3	----	50-25	8-4	7.3-8.7	2.51-1.25	14-10	Partial
BIOREF Score=1	----	<25	<4	>8.7	<1.25	8-4	Non

MSCI scoring range calculated using Central Plains/Grand/Chariton EDU BIOREF samples ($n=24$). Bold=suboptimal.

Fall 2014

Percent dominant taxa and percent EPT Taxa are presented for fall 2014 in Table 6. Each of the three orders making up the EPTT metric was more abundant than BIOREF conditions. The dominant family in the fall varied among stations. Chironomidae was dominant at Stations 1 and 3, Caenidae (*Caenis latipennis*) was dominant at Stations 4 and 5, and Hydropsychidae (primarily *Cheumatopsyche*) was dominant at Station 2.

Table 6
 Fall 2014 Macroinvertebrate Composition

Station #	EDU BIOREF	Big Cr. #1	Big Cr. #2	Big Cr. #3	Big Cr. #4	Big Cr. #5
% EPT Orders						
% Ephemeroptera	32.3	45.1	43.2	48.3	53.9	52.3
% Plecoptera	0.0	0.0	0.1	0.0	0.3	0.4
% Trichoptera	3.3	13.1	33.5	10.9	8.0	21.6
Total EPT %	35.6	58.2	77.7	59.2	62.2	74.3
% Diptera	46.6	31.6	18.2	31.0	25.9	15.2
% Abundance of the Top Five Dominant Families						
Chironomidae	44.5	23.8	14.5	28.5	22.9	13.9
Heptageniidae	3.5	17.9	17.4	13.9	16.1	17.0
Caenidae	18.7	12.9	13.7	21.2	25.3	25.7
Hydropsychidae	0.3	8.8	30.2	6.5	5.4	15.4
Baetidae	1.2	7.8	6.5	10.5	7.7	
Hyalellidae	2.3					
Leptoceridae	2.8					6.3

Numbers in bold represent dominant families.

Ephemeroptera was the dominant order at all five Big Creek stations during the fall 2014 sampling season, making up between 43.2 and 53.9 percent of samples. Mayfly abundance among Big Creek samples was higher than BIOREF samples, where mayflies accounted for 32.3 percent of samples. *Caenis latipennis* was the dominant mayfly species at all Big Creek stations, making up between 27.8 percent of mayflies at Station 1 to 49.2 percent at Station 5. Only one other mayfly taxon, *Baetis*, was abundant on a consistent basis among stations. This genus accounted for between 19.8 percent of mayflies at Station 3 to 6.8 percent at Station 5. Several other mayfly taxa were locally abundant at one or two stations (e.g. *Maccaffertium terminatum* and *Stenacron*) but relatively rare at others.

Taeniopteryx was the only stonefly present among at least some Big Creek stations. No stoneflies were present in Station 1 and 3 samples, and the remaining stations had no more than four individuals.

Caddisflies were the second or third most abundant taxonomic order among Big Creek stations in fall 2014, making up between 8.0 and 33.5 percent of samples. By comparison, caddisflies made up 3.3 percent of BIOREF fall samples in the Central Plains/Grand/Chariton EDU. Three genera accounted for nearly all caddisflies. *Cheumatopsyche*, *Hydropsyche*, and *Nectopsyche* made up between roughly 98 and 99 percent of caddisflies in samples. Regarding *Hydropsyche*, this genus was somewhat abundant among Stations 1, 2, and 5 (roughly 13 to 32 percent of caddisflies), but only a few individuals were present in the Station 3 sample and a single individual was present at Station 4. *Cheumatopsyche* was particularly dominant among caddisflies at Station 2, where it accounted for over 70 percent of caddisflies and nearly a quarter of the sample as a whole. This genus was more than four times more numerous at Station 2 than any of the

remaining Big Creek stations. Four other caddisfly taxa were present among stations, but none of these were at all sites and, when they were found, they were relatively rare.

Diptera tended to be more abundant among BIOREF samples compared to Big Creek sites. Although Chironomidae made up the majority of Diptera taxa, no single taxon was overwhelmingly dominant. The taxa group *Thienemannimyia* grp. was consistently the most abundant chironomid, but it made up no more than a third of this family. There were few other dipteran taxa, and only the black fly *Simulium* was abundant.

Other notable taxa included the amphipod *Hyaella azteca*, which was well represented among all stations. Although it ranked in the top five in abundance only at Station 1, it was in the top 10 at all sites except Station 2. Mollusks (snails and fingernail clams) were absent from the samples of most stations. Station 4 had four molluscan taxa, each in low numbers, and Station 3 had a single fingernail clam (Pisidiidae) that was found during the final large/rare portion of laboratory processing. The remaining three stations had no mollusks in their samples. Although aquatic worms (Tubificidae and Enchytraeidae) were present in fall samples from all Big Creek stations, they were relatively rare. No more than 15 aquatic worms (≤ 1.6 percent of samples) were found in Big Creek samples.

Spring 2015

Percent dominant taxa and percent EPT Taxa are presented for spring 2015 in Table 7. Whereas Ephemeroptera was the dominant order in fall Big Creek samples, Diptera was the dominant order in spring, accounting for roughly 60-80 percent of spring samples. Unlike fall, the three orders making up the EPTT metric were variable compared to BIOREF samples. Whereas Ephemeroptera made up 21.9 percent of BIOREF samples, they accounted for no more than 15.2 percent of Big Creek samples. Stoneflies were rare in BIOREF samples, but they were nearly absent in Big Creek. Although caddisflies made up a lower percentage of spring samples compared to fall, the percentage of caddisflies among Big Creek samples was higher than BIOREF samples. Chironomidae was overwhelmingly the dominant family at all stations. Chironomids accounted for 59.6 percent of the Station 3 and BIOREF samples. The percentage of chironomids was much higher among the remaining Big Creek stations compared to BIOREF samples.

Table 7
 Spring 2015 Macroinvertebrate Composition

Station #	EDU BIOREF	Big Cr. #1	Big Cr. #2	Big Cr. #3	Big Cr. #4	Big Cr. #5
% EPT Orders						
% Ephemeroptera	21.9	13.1	15.2	14.0	10.2	12.8
% Plecoptera	0.8	0.1	0.1	0.1	0.0	0.0
% Trichoptera	1.0	3.3	5.1	5.0	2.2	2.8
Total %EPT	23.7	16.5	20.3	19.1	12.4	15.6
% Diptera	64.8	80.9	76.9	61.4	79.9	81.6
% Abundance of the Top Five Dominant Families						
Chironomidae	59.6	78.5	73.9	59.6	76.3	76.8
Leptophlebiidae	1.1	4.3	4.0	8.1	4.9	4.6
Heptageniidae	1.5	4.2	6.2		2.6	3.0
Caenidae	18.4	3.9	4.9	3.9		5.0
Hydropsychidae	0.2	2.2	4.0			
Tubificidae	2.5			11.2	4.7	
Leptoceridae	0.6			3.6		
Simuliidae	2.5				2.5	4.5

Numbers in bold represent dominant families.

Ephemeroptera was second in abundance at all stations, making up between 10.2 and 15.2 percent of samples. *Leptophlebia* and *C. latipennis* were the most numerous mayflies and were present in roughly similar abundance among Big Creek stations. These two taxa combined to account for between 63 and 89 percent of mayflies. Two other taxa, *Heptagenia* and *Maccaffertium* spp., were abundant at a few stations, but not consistently throughout the study reach.

Stoneflies were present only at Stations 1-3. Among these stations, only a single individual of *Taeniopteryx* was found in each sample.

Caddisflies were the third or fourth most abundant taxonomic order among Big Creek stations in spring 2015, making up between 2.2 and 5.1 percent of samples. BIOREF samples had an average of 1.0 percent caddisflies. *Cheumatopsyche* and *Nectopsyche* spp. were the dominant caddisfly taxa, making up between 65.5 and 100 percent of caddisflies. These two taxa were the only caddisflies present at Station 4; by comparison, the remaining Big Creek stations had either four or five caddisfly taxa.

With the exception of Station 3, each of the Big Creek stations had a higher percentage of Diptera in samples than BIOREF stations. The majority of Diptera taxa were chironomids. Within Chironomidae, *Cricotopus/Orthocladius* grp. and *Thienemanniella* were dominant, accounting for between 34.8 and 61.1 percent of the family. Similar to fall samples, there were few dipteran taxa other than chironomids. Of the seven Diptera taxa aside from chironomids, the black fly *Simulium* and biting midges in the family Ceratopogonidae were most abundant.

Aquatic worms (predominantly Tubificidae) were present in similar abundance among most stations in spring compared to fall, with the exception of Stations 3 and 4. The number of tubificids at these two stations was sufficiently high for the family to rank among the top five dominant taxa in spring samples. The amphipod *H. azteca*, which was common among fall samples, was present in lower abundance in the spring except at Station 2, where it was absent. Compared to fall, mollusks were similarly rare in spring. Only three molluscan taxa were present among all Big Creek sites, with most sites having either a single individual present in samples or none. Station 3 was the only site to have multiple mollusk individuals, but all were fingernail clams.

4.4 Physicochemical Data

Fall 2014 *in situ* water quality data and results of surface water grab sample chemical analysis are presented in Table 8. In addition, Bethany WWTF effluent water quality parameters are presented for comparison. Effluent information was gathered from Discharge Monitoring Reports (DMRs), which can be searched by date and permit number at the Department website <https://www.dnr.mo.gov/cwis/report/parm9.do>.

Sample collection in fall 2014 was challenging due to high water levels in Big Creek that persisted through much of the late summer and fall (Figure 3). Flow values recorded during the fall were roughly 10 times higher than median flows.

Table 8
 Fall 2014 Physiochemical Water Parameters

Parameters	Big Cr. #1	Big Cr. #2	Big Cr. #3	Big Cr. #4	Big Cr. #5	Big Cr. #5 (dup.)	WWTF [†]
Nutrient, Chloride, and NFR Concentrations							
Ammonia as N (mg/L)	0.096	0.089	0.072	0.087	0.096	0.074	0.1
NO ₃ + NO ₂ as N (mg/L)	0.54	0.48	0.54	0.81	0.43	0.45	4.8
Total N (mg/L)	1.13	1.09	1.12	1.47	1.01	1.02	-
Total P (mg/L)	0.15	0.15	0.14	0.19	0.13	0.12	0.69
Chloride (mg/L)	6.88	7.12	7.30	7.98	6.45	6.78	-
Non-Filterable Residue (mg/L)	26.0	33.0	17.0	17.0	16.0	17.0	8.7
<i>In situ</i> Water Quality Measurements and Turbidity							
Temperature (°C)	12.3	12.9	13.6	13.9	13.5	13.5	19.3
Dissolved Oxygen (mg/L)	9.86	9.97	9.84	9.73	9.61	9.68	6.0
Specific Conductance (µS/cm)	412	408	424	419	402	401	865*
pH (su)	7.9	8.0	8.0	8.0	8.0	8.0	7.1-7.4
Turbidity (NTU)	17.6	20.2	17.7	14.3	14.2	14.2	-
Flow (cfs)	97.6	84.1	**	80.5	71.1	-	0.5

[†]Monthly average values from the Bethany WWTF October 2014 Discharge Monitoring Report (except pH, which was minimum-maximum); *specific conductance of effluent measured *in situ* by WQMS staff on October 21, 2014; **flow not recorded due to user error; values in bold exceed U.S. EPA's recommended ambient water quality criteria recommendations; dup.=duplicate water quality sample.

Fall water chemistry parameters exhibited few notable trends among stations. Little variation existed among most *in situ* water quality measurements. Temperature, dissolved oxygen, conductivity, and pH all were similar among stations. Dissolved oxygen was

well above the 5 mg/L threshold listed in Missouri's WQS, and conductivity in Big Creek was unchanged despite the influx of relatively high conductivity effluent. Flow increased predictably from upstream stations to downstream, and turbidity was slightly higher among the three downstream stations compared to Stations 4 and 5.

Nutrient parameters and chloride demonstrated a few trends relative to the Bethany WWTF. $\text{NO}_3+\text{NO}_2\text{-N}$ concentrations were highest at Station 4, which was just downstream of the Bethany WWTF outfall. Likewise, TN, TP, and chloride also were slightly higher among stations downstream of the outfall. $\text{NH}_3\text{-N}$, however, was slightly lower in most stations downstream of the outfall compared to Station 5.

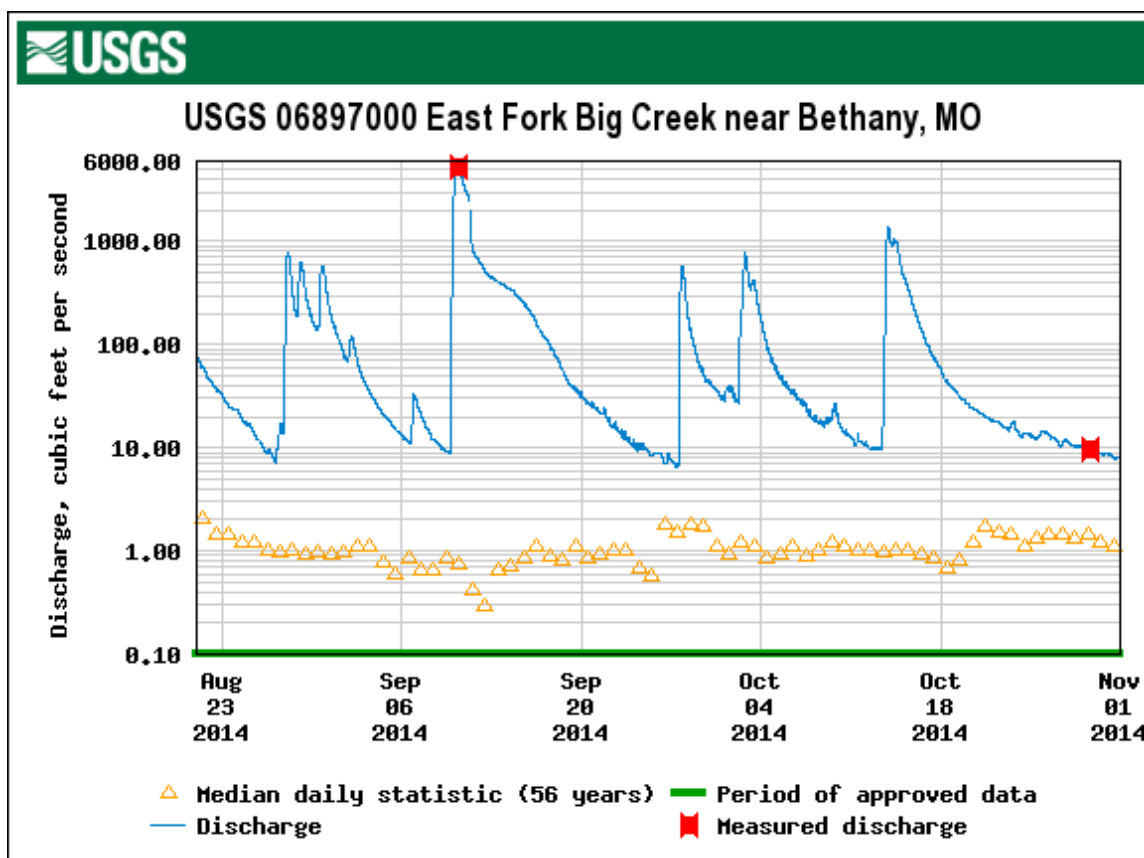


Figure 3. USGS hydrograph at East Fork Big Creek near Bethany, Missouri, August 23-November 1, 2014.

Spring 2015 *in situ* water quality data, results of surface water grab sample chemical analysis, and Bethany WWTF DMR results are presented in Table 9.

Flow during spring was roughly half of that observed in fall and was closer to median flows in the watershed (Figure 4). Within the study reach, flow tended to increase from upstream to downstream stations. Temperature and dissolved oxygen were highest among Stations 1-3, which were sampled in the afternoon. Stations 4 and 5 were sampled the following morning and had correspondingly lower temperature and dissolved oxygen

concentrations. Conductivity and turbidity were nearly identical among stations, and pH was similar among stations with one exception. Whereas most stations ranged from a pH of 7.6 to 8.3, Station 4 had a pH of 6.9. This difference was notable due to the fact that the station just upstream of the outfall had a pH of 7.9

As was the case with the fall water quality results, a few trends in nutrient parameters were observed among Big Creek stations. $\text{NH}_3\text{-N}$ and TN were higher at Station 4, downstream of the outfall compared to Station 5 upstream. Although $\text{NO}_3\text{+NO}_2\text{-N}$ was higher at Station 4 than Station 5, concentrations were highest at Stations 1 and 2, which were well downstream of the WWTF. TP appeared to be unchanged relative to the outfall.

Table 9
 Spring 2015 Physiochemical Water Parameters

Parameters	Big Cr. #1	Big Cr. #2	Big Cr. #3	Big Cr. #4	Big Cr. #5	Big Cr. #5 (dup.)	WWTF [†]
Nutrient, Chloride, and NFR Concentrations							
Ammonia as N (mg/L)	0.066	0.10	0.17	0.40	0.063	0.065	21.8
$\text{NO}_3 + \text{NO}_2$ as N (mg/L)	0.14	0.11	0.077	0.058	0.041	0.044	0.2
Total N (mg/L)	0.67	0.71	0.68	0.90	0.52	0.50	-
Total P (mg/L)	0.058	0.055	0.052	0.044*	0.039*	0.043*	2.55
Chloride (mg/L)	10.30	9.99	10.2	11.2	10.2	9.92	-
Non-Filterable Residue (mg/L)	8.0	7.0	7.0	5.0	5.0	< 5.0**	7.7
<i>In situ</i> Water Quality Measurements and Turbidity							
Temperature (°C)	8.2	8.6	8.5	6.2	6.1	6.1	9.7
Dissolved Oxygen (mg/L)	12.20	12.54	12.68	11.32	11.80	11.78	3.3
Specific Conductance ($\mu\text{S}/\text{cm}$)	392	390	392	391	381	382	-
pH (su)	7.6	8.3	8.2	6.9	7.9	7.9	6.9-7.4
Turbidity (NTU)	6.4	8.3	6.3	6.4	6.5	6.8	-
Flow (cfs)	53.9	46.6	46.4	42.1	38.6	38.4	0.3

[†]Monthly average values from the Bethany WWTF March 2015 Discharge Monitoring Report (except pH, which was minimum-maximum); *estimated value, detected below the Practical Quantitation Limit; **below detectable concentrations; values in bold exceed U.S. EPA's recommended ambient water quality criteria recommendations, with the exception of $\text{NH}_3\text{-N}$, which was a permit exceedance.

When comparing water chemistry parameters between seasons, several differences were present. As mentioned earlier, flow was much higher during the fall compared to spring; turbidity readings also were considerably higher in the fall. Other *in situ* measurements differed based on seasonal changes, such as lower temperature and higher dissolved oxygen among stations in the spring. Conductivity was only slightly higher during the fall at all stations. pH was nearly identical among seasons, with the exception of a relatively low reading at Station 4 in spring.

Several differences in nutrient concentrations also were observed between seasons. The March 2015 average $\text{NH}_3\text{-N}$ concentration was much higher in the WWTF effluent compared to the October 2014 average. $\text{NH}_3\text{-N}$ levels among stations downstream of the outfall were highest at Station 4, and they gradually decreased among downstream stations. Ultimately, the Station 1 $\text{NH}_3\text{-N}$ concentration was nearly identical to that of

Station 5. Despite higher spring $\text{NH}_3\text{-N}$ concentrations, $\text{NO}_3\text{+NO}_2\text{-N}$ and TN both were lower among all stations in the spring. The concentration of $\text{NO}_3\text{+NO}_2\text{-N}$ in effluent was considerably lower in the spring as well. Although TP was higher in the WWTF effluent during spring, it was much lower in grab samples among the sample stations compared to fall.

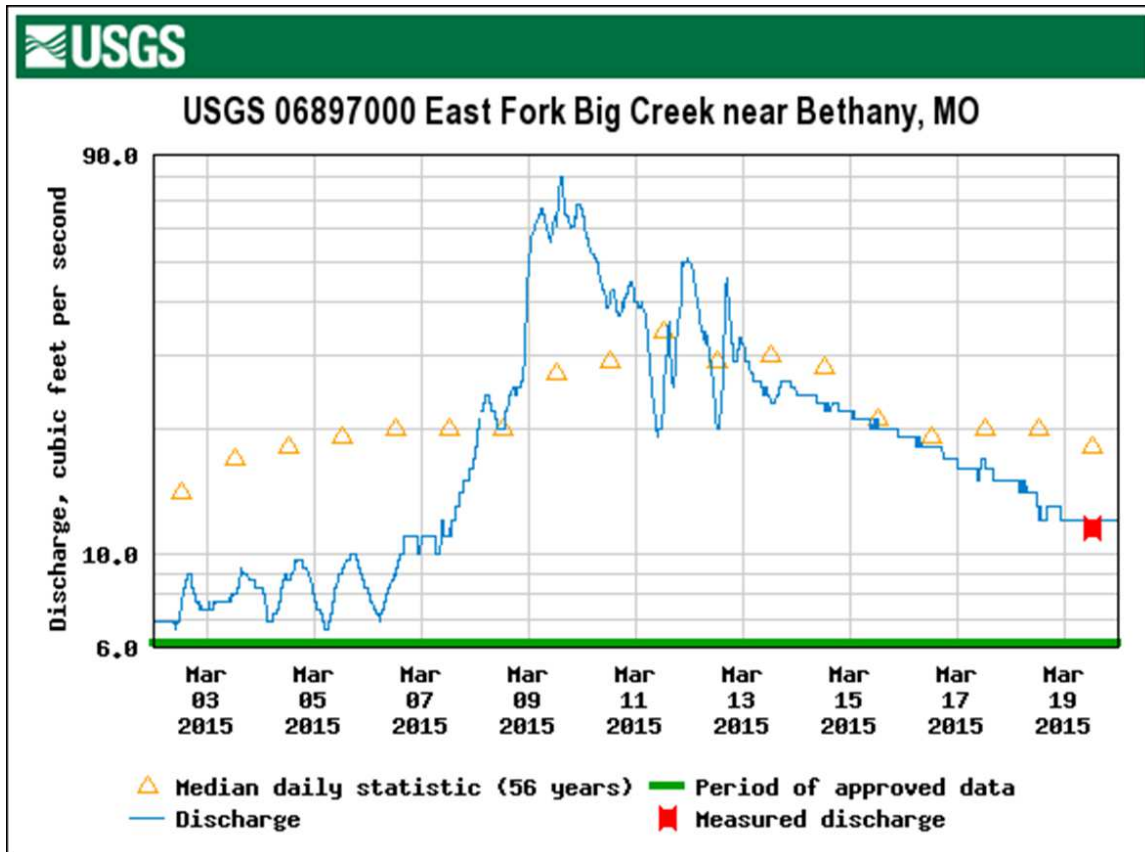


Figure 4. USGS hydrograph at East Fork Big Creek near Bethany, Missouri, March 3-19, 2015.

Currently there are no nutrient criteria in use for Missouri streams and rivers. Alternatively, Big Creek nutrient values were compared to the USEPA's December 2000 Ambient Water Quality Criteria Recommendations for Rivers and Streams in Nutrient Ecoregion IX, Sub-Ecoregion 40 (USEPA 2000). USEPA's recommended values include: 0.23 mg/L $\text{NO}_3\text{+NO}_2\text{-N}$; 0.093 mg/L TP; 0.71 mg/L TN; and 15.5 NTU for turbidity. $\text{NO}_3\text{+NO}_2\text{-N}$, TP, and TN concentrations were higher than the USEPA's recommended values at all Big Creek sites during the fall sample season. Turbidity was higher than USEPA's recommended values at Stations 1-3, but the two upstream stations had turbidity just below the threshold.

For spring samples, only TN exceeded USEPA's recommended value. The Station 2 TN concentration was equal to USEPA's recommendation, and Station 4 exceeded it. The

remaining nutrients and turbidity were well below USEPA's recommended concentrations in spring 2015.

5.0 Discussion

5.1 Habitat Assessment

All Big Creek habitat assessment scores exceeded the 75 percent threshold for SHAPP recommendations, and three of the test-site habitat scores exceeded the BIOREF score. Although several habitat assessment parameters were lower than optimal quality (sediment deposition, vegetative protection, and epifaunal substrate/available cover), they all were similar to the BIOREF station. Channel flow status and bank stability tended to be in good condition. Channel flow status, which measures the amount of available substrate occurring in the wetted channel, likely attained high scores due to high flows during the fall 2014 sample season when habitat conditions were assessed.

5.2 Biological Assessment

All five Big Creek stations attained fully supporting MSCI scores during both seasons. With the exception of Station 4 in spring 2015, which had an MSCI score of 18, all Big Creek sites achieved the highest possible score of 20. Macroinvertebrate metric values in fall 2014 tended to be much higher than their respective threshold values. Big Creek had unusually high flows for several months prior to the fall sampling season. These conditions likely resulted in good oxygenation during the summer months preceding macroinvertebrate sampling as well as abundant habitat for macroinvertebrate colonization and perhaps more habitat diversity for niche partitioning (Statzner et al. 1988, Gore et al. 2001). These high flows (80.5 cfs at Station 4) also would have diluted Bethany WWTF effluent (0.5 cfs October monthly average, according to the DMR) that otherwise could affect an aquatic macroinvertebrate community.

Based on spring and fall macroinvertebrate metric threshold values for the Central Plains/Grand/Chariton EDU, TR and EPTT values would be expected to remain similar among seasons. However, TR and EPTT values were notably lower in spring samples for this study. Spring TR values were between 2 (Station 5) and 21 (Station 4) taxa lower in spring 2015 compared to the previous fall. Likewise, spring EPTT values were between 4 (Station 1) and 12 (Stations 3 and 4) taxa lower than fall. Despite these lower values, only EPTT at Station 4 declined sufficiently to result in a suboptimal score. All remaining stations had the highest possible score for each of the biological metrics. As noted earlier, fall metric values were unusually high compared to threshold values. Station 3 TR and EPTT values each tied the highest BIOREF fall values for the EDU, and the Station 4 TR was higher than any BIOREF value. Although notably lower than fall, spring TR and EPTT values were more similar to thresholds calculated for the EDU and tended to be more toward the mid-range of BIOREF values. The decrease in biological metric values noted from fall to spring may, therefore, have been a return of the macroinvertebrate community to a state that is more typical of this system during average flows.

In addition to discharge, end-of-pipe NH₃-N permit exceedances reported in the Bethany WWTF DMR in February and March 2015 may have contributed to lower spring

biological metric scores (see Section 5.3). These exceedances, combined with lower flows for dilution, may have affected the macroinvertebrate community in spring. Station 5 TR decreased from 65 taxa in fall to 63 in spring. Station 4, which was immediately downstream of the outfall, experienced a decrease in TR from 80 in fall to 59 taxa in spring. Whereas EPTT (a generally pollution-sensitive metric) was similar among stations in fall (a range of 19-24), Station 4 had the fewest EPTT in spring.

5.3 Physicochemical Data

The most notable feature regarding Big Creek physicochemical features was that the magnitude of flow was approximately 10 times higher than median flows for the fall season. Despite these higher flows, the Bethany WWTF appeared to have affected a few nutrient parameters in Big Creek, based on comparing the two stations that bracketed the outfall—Station 5 (upstream) and Station 4 (just downstream of the outfall). In fall 2014, Station 4 had higher concentrations of $\text{NO}_3+\text{NO}_2\text{-N}$, TN, TP, and chloride than Station 5. Only $\text{NO}_3+\text{NO}_2\text{-N}$ was notably higher (nearly double) at Station 4; the remaining analytes listed were only slightly higher. The Bethany WWTF appeared to have no effect on Big Creek $\text{NH}_3\text{-N}$ concentrations in fall—Station 4 $\text{NH}_3\text{-N}$ concentrations were actually slightly lower than either of the Station 5 duplicate samples.

Flow during spring 2015 was roughly half of what was recorded during the previous fall. These spring discharge measurements were typical of Big Creek spring flows. Although most *in situ* water quality measurements were unremarkable in the spring, pH at Station 4 appeared to be an outlier. Station 4 pH (6.9) was one full unit lower than Station 5 (7.9), which because of the logarithmic pH scale, was 10 times more acidic. Sites downstream of Station 4 had pH readings that were similar to one another (Stations 2 and 3 had a pH of 8.3 and 8.2, respectively). The Bethany WWTF DMR reported a range of pH 6.9 to 7.4 during March 2015, but it is unlikely that effluent is the sole contributor to these readings. Regardless of the difference in pH among stations, none of the readings were in violation of WQS.

Two Big Creek water chemistry parameters were notable in spring 2015 that appeared to change in response to Bethany WWTF effluent. Station 4 $\text{NH}_3\text{-N}$ and TN concentrations were higher than Station 5, likely as a result of effluent. According to Bethany WWTF DMRs, $\text{NH}_3\text{-N}$ for February 2015 (daily maximum = 12.9 mg/L) and March 2015 (daily maximum = 21.8 mg/L) exceeded the facility's permit limits (daily maximum limit = 11.8 mg/L and monthly average limit = 3.3 mg/L between October 1 and March 31).

The February end-of-pipe $\text{NH}_3\text{-N}$ concentration exceeded the chronic WQS, and the March $\text{NH}_3\text{-N}$ concentration exceeded the acute standard (MoDNR 2014). Although the reported Bethany WWTF flow (0.3 cfs for March 2015) was small compared Big Creek (42.1 cfs at Station 4), the duration of these exceedances and maximum $\text{NH}_3\text{-N}$ concentrations are unknown. It is also unknown whether $\text{NH}_3\text{-N}$ in Big Creek ever approached sufficient concentrations to affect the macroinvertebrate community prior to spring sampling. In Big Creek water quality grab samples collected during spring 2015 sampling, $\text{NH}_3\text{-N}$ concentrations showed a 6-fold increase from Station 5 upstream of the

outfall compared to Station 4. However, the Station 5 $\text{NH}_3\text{-N}$ concentration was very low in duplicate samples (0.063 and 0.065 mg/L) such that the 6-fold increase observed at Station 4 (0.40 mg/L), was far lower than the chronic $\text{NH}_3\text{-N}$ standard.

In comparing water quality parameters between seasons, a few factors were notable. High flows in the months preceding fall sampling likely affected water quality analytes and benefited the macroinvertebrate community. Turbidity was higher among stations in the fall season, which was likely in response to repeated heavy rains in the watershed and high flows during the summer and early fall of 2014. $\text{NH}_3\text{-N}$ was higher in spring samples compared to fall, which may have been due to Bethany WWTF exceedances and lower Big Creek flows available to provide dilution. Despite higher $\text{NH}_3\text{-N}$ concentrations in the spring, TN concentrations were lower among all stations compared to fall. Because TN is the sum of $\text{NH}_3\text{-N}$, $\text{NO}_3+\text{NO}_2\text{-N}$ (which was also lower in the spring), and organically bonded nitrogen (APHA 1998), it would seem that the higher TN concentrations in the fall were due to higher levels of organically bonded nitrogen that were not as prevalent in the spring. Although TP was considerably higher in the Bethany WWTF DMR in spring compared to fall, all Big Creek stations had lower TP concentrations in spring. The Station 4 TP concentration was nearly identical to that of Station 5, indicating that the Bethany WWTF effluent did not affect TP concentrations in the creek.

In July and September 2003, the acute $\text{NH}_3\text{-N}$ criterion was violated on three occasions, and the dissolved oxygen criterion was violated in six of 11 samples downstream of the Bethany WWTF (MoDNR 2015b). These violations occurred during low flow conditions which, according to the Department TMDL information fact sheet (MoDNR 2015b), can last at least 30 days per year on Big Creek. This current bioassessment was conducted following unusually high summer flows that kept the creek well oxygenated during a time of year that is typified by very low flows, low dissolved oxygen and, according to the fact sheet, episodic acute $\text{NH}_3\text{-N}$ concentrations. In 2014, however, the Bethany WWTF reported no $\text{NH}_3\text{-N}$ exceedances in the summer months preceding fall sampling for this study, either in the effluent or the downstream monitoring station. Given the DMR results and the high flows that occurred in Big Creek during the summer of 2014, it is unlikely that $\text{NH}_3\text{-N}$ concentrations were problematic. It does appear, however, that the Bethany WWTF does have occasional $\text{NH}_3\text{-N}$ exceedances, as noted in DMRs from the late winter of 2015. Although the same DMRs indicated that no violations of WQS had occurred in a downstream monitoring station, $\text{NH}_3\text{-N}$ exceedances could have negative effects on the Big Creek aquatic community if they were to occur during stressful conditions (e.g. low flow, high temperature, low dissolved oxygen).

6.0 Summary

1. All five Big Creek stations had fully supporting MSCI scores during both the fall 2014 and spring 2015 sample seasons.
2. Of the 10 macroinvertebrate samples collected, nine had the highest possible MSCI score of 20; the remaining station attained an MSCI score of 18.

3. Fall 2014 TR and EPTT values far exceeded their respective threshold values. Spring 2015 values for these metrics tended to be (in some cases) much lower, but nearly all were in excess of their thresholds.
4. Discharge in the Big Creek watershed was roughly 10 times higher than median flows during the summer and early fall months of 2014. Spring 2015 flows were more typical for that time of year.
5. In fall 2014, concentrations of $\text{NO}_3+\text{NO}_2\text{-N}$, TN, TP and chloride were higher at Station 4, which was located immediately downstream of the Bethany WWTF outfall, compared to the upstream Station 5.
6. In spring 2015, $\text{NH}_3\text{-N}$, $\text{NO}_3+\text{NO}_2\text{-N}$, and TN were higher at Station 4 than Station 5. Concentrations of $\text{NO}_3+\text{NO}_2\text{-N}$, however, were highest at downstream Stations 1 and 2.
7. Discharge monitoring reports for the Bethany WWTF reported effluent $\text{NH}_3\text{-N}$ concentrations in exceedance of state operating permit requirements in February and March 2015. The February exceedance violated the WQS chronic threshold, and the March exceedance violated the acute threshold concentration.
8. Despite effluent exceedances during February and March, $\text{NH}_3\text{-N}$ concentrations were well below WQS chronic threshold values in Big Creek water-quality grab samples.

7.0 Conclusions

Big Creek MSCI scores indicate that the protection of aquatic life designated use as listed in the Missouri WQS are being met.

Tests of the null hypotheses resulted in the following conclusions.

1. Macroinvertebrate assemblages in Big Creek samples will be similar to the Central Plains/Grand/Chariton EDU wadeable/perennial stream biological criteria. This hypothesis was accepted because the Big Creek sample stations had MSCI scores that were in the fully supporting range.
2. Macroinvertebrate assemblages will not differ among longitudinally separate Big Creek stream segments. This hypothesis was accepted because all Big Creek test station MSCI scores were in the fully supporting range and few differences were observed among macroinvertebrate community attributes.
3. Physicochemical water quality from Big Creek samples will meet Missouri's WQS (MoDNR 2014). This hypothesis was accepted because no water quality standards were violated during the study period.

4. Physicochemical water quality will not differ among longitudinally separate reaches of Big Creek. This hypothesis was rejected because several nutrient values were higher among stations located downstream of the Bethany WWTF outfall.
5. Habitat quality will be similar among Big Creek stream segments. This hypothesis was accepted because habitat assessment scores of Big Creek stations were similar to one another.
6. Habitat quality will be similar between Big Creek and biocriteria reference streams. This hypothesis was accepted because Big Creek habitat assessment scores were at least 96 percent of the reference stream score.

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Appendix A

Fall 2014 Big Creek Macroinvertebrate Taxa Lists

Spring 2015 Big Creek Macroinvertebrate Taxa Lists

Aquid Invertebrate Database Bench Sheet Report**Big Cr [14949], Station #1, Sample Date: 10/21/2014 12:05:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	2		1
AMPHIPODA			
Hyaella azteca		36	2
COLEOPTERA			
Dineutus		1	
Helichus lithophilus	1	6	
Macronychus glabratus		1	
Stenelmis	1		1
DIPTERA			
Ablabesmyia		7	1
Ceratopogoninae		1	
Chrysops		1	
Cladotanytarsus			1
Corynoneura		5	1
Cricotopus bicinctus		1	
Cricotopus/Orthocladius		1	3
Dicrotendipes			9
Endochironomus	1		
Hydrobaenus		2	5
Labrundinia		3	
Nanocladius			1
Parakiefferiella			2
Paratanytarsus		1	
Paratendipes	1		
Phaenopsectra	1		1
Polypedilum fallax grp			1
Polypedilum flavum	2	3	1
Polypedilum halterale grp	2		
Polypedilum illinoense grp	1	6	1
Polypedilum scalaenum grp			2
Pseudochironomus			1
Rheocricotopus	1	1	
Rheotanytarsus		6	1
Simulium	22	7	26
Stenochironomus			16
Tanytarsus		3	1
Thienemanniella	5	20	4
Thienemannimyia grp.	7	31	10
Zavrelimyia		1	
EPHEMEROPTERA			

Aquid Invertebrate Database Bench Sheet Report**Big Cr [14949], Station #1, Sample Date: 10/21/2014 12:05:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Acerpenna	3	2	3
Baetis	5	1	31
Baetisca lacustris	1		5
Caenis hilaris	1		1
Caenis latipennis	33	39	20
Fallceon			12
Heptagenia	4	14	
Isonychia rufa		1	3
Leptophlebiidae	3	13	
Leucrocuta	1		
Maccaffertium terminatum	10		5
Stenacron	21	18	27
Stenonema femoratum	16	10	5
Tricorythodes	4	14	4
HEMIPTERA			
Rhagovelia			1
MEGALOPTERA			
Sialis		-99	
ODONATA			
Argia	1	8	1
Calopteryx		-99	
Enallagma	1		
Epithea (Epicordulia)		-99	
Gomphidae	2	1	1
Hetaerina		-99	
Ischnura		-99	
Macromia		-99	
Nasiaeschna pentacantha		-99	
Progomphus obscurus	1		
TRICHOPTERA			
Cheumatopsyche	7	13	13
Hydropsyche	10	7	14
Nectopsyche		13	
Nectopsyche diarina	1	15	1
Oecetis		2	
TUBIFICIDA			
Enchytraeidae		1	
Tubificidae	3	1	

Aquid Invertebrate Database Bench Sheet Report**Big Cr [14950], Station #2, Sample Date: 10/21/2014 1:25:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	2		
AMPHIPODA			
Hyaella azteca	1	9	2
COLEOPTERA			
Berosus	1		
Dytiscidae	1		
Helichus lithophilus	1	6	1
Macronychus glabratus			1
Peltodytes	3		
Stenelmis	3	1	2
DIPTERA			
Ablabesmyia		1	
Ceratopogoninae	2		
Chrysops		1	
Corynoneura	2	1	4
Cricotopus/Orthocladius		1	1
Cryptochironomus	2		
Cryptotendipes	2		
Dicrotendipes			5
Eukiefferiella		1	
Hydrobaenus	8		2
Micropsectra		1	
Nanocladius		3	2
Polypedilum flavum		9	7
Polypedilum halterale grp	14		1
Polypedilum illinoense grp		1	
Polypedilum scalaenum grp	5		
Rheocricotopus			1
Rheotanytarsus		1	2
Simulium		10	23
Stelechomyia			1
Stenochironomus			8
Stictochironomus	1		
Tanypus	1		
Tanytarsus	2	1	
Thienemanniella	1	1	2
Thienemannimyia grp.	3	15	27
Zavrelimyia	1		
EPHEMEROPTERA			

Aquid Invertebrate Database Bench Sheet Report**Big Cr [14950], Station #2, Sample Date: 10/21/2014 1:25:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Acerpenna	2		1
Baetis		3	43
Baetisca lacustris	1		
Caenis hilaris	4	2	
Caenis latipennis	83	35	9
Fallceon		6	1
Heptagenia		17	6
Isonychia rufa		9	5
Leptophlebiidae	8	11	2
Leucrocuta	8		1
Maccaffertium terminatum	54	8	16
Paracloeodes	1		
Procloeon	1		
Pseudocloeon		3	2
Stenacron	20	17	20
Stenonema femoratum	2		
Tricorythodes	6	8	5
ODONATA			
Argia	1	5	1
Enallagma		3	
Epithea (Epicordulia)	-99		
Gomphidae	1		
Ischnura	1		
Macromia	2		
Progomphus obscurus	-99		
PLECOPTERA			
Taeniopteryx		1	
TRICHOPTERA			
Cheumatopsyche	5	106	122
Hydropsyche		7	54
Hydroptila			1
Nectopsyche	6	3	1
Nectopsyche diarina	1	15	2
Oecetis	1	2	
TRICLADIDA			
Planariidae		1	

Aquid Invertebrate Database Bench Sheet Report**Big Cr [14951], Station #3, Sample Date: 10/21/2014 2:55:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	3	1	
AMPHIPODA			
Hyaella azteca	2	38	
COLEOPTERA			
Agabus		1	
Dubiraphia		1	
Helichus lithophilus	1		2
Macronychus glabratus			3
Peltodytes		1	
Stenelmis			4
DIPTERA			
Ablabesmyia	1	2	
Ceratopogoninae	9		
Chironomidae	3	2	
Cladotanytarsus	1		
Corynoneura	1	3	
Cricotopus/Orthocladius		1	3
Cryptochironomus	9		
Cryptotendipes	1		
Dicrotendipes			1
Hydrobaenus	3		2
Labrundinia	1		
Nanocladius		1	1
Paracladopelma	1		
Paralauterborniella	3		
Paratanytarsus		3	
Polypedilum flavum		5	8
Polypedilum halterale grp	57		
Polypedilum illinoense grp	6	6	2
Polypedilum scalaenum grp	21		
Rheotanytarsus	10	17	5
Saetheria	1		
Simulium			12
Stenochironomus			17
Tanytarsus	6	3	7
Thienemanniella		8	
Thienemannimyia grp.	6	11	15
Tipula		1	
EPHEMEROPTERA			

Aquid Invertebrate Database Bench Sheet Report**Big Cr [14951], Station #3, Sample Date: 10/21/2014 2:55:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Acentrella			1
Acerpenna			1
Baetis		2	83
Caenis hilaris	8	1	1
Caenis latipennis	91	73	15
Centroptilum	1		
Fallceon		2	1
Heptagenia	1	5	8
Hexagenia	1		
Leptophlebiidae	1	10	1
Leucrocuta	3		
Maccaffertium terminatum	11	33	20
Plauditus			1
Pseudocloeon		2	
Stenacron	13	14	14
Stenonema femoratum	1		1
Tricorythodes	1	5	4
HEMIPTERA			
Belostoma		-99	-99
Corixidae	1		
Sigara		1	1
LUMBRICINA			
Lumbricina	1		
LUMBRICULIDA			
Lumbriculidae	1		
MEGALOPTERA			
Sialis		-99	
ODONATA			
Argia		6	1
Boyeria		-99	
Enallagma		4	1
Epitheca (Epicordulia)		-99	
Gomphidae	3		
Hetaerina		-99	
Macromia	-99	-99	
Nasiaeschna pentacantha		-99	
Progomphus obscurus	1		
TRICHOPTERA			
Cheumatopsyche	2		48
Hydropsyche		1	7
Nectopsyche	2	5	

Aquid Invertebrate Database Bench Sheet Report**Big Cr [14951], Station #3, Sample Date: 10/21/2014 2:55:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Nectopsyche diarina	3	17	11
Ptilostomis		1	
TUBIFICIDA			
Limnodrilus hoffmeisteri	1		
Tubificidae	9		
VENEROIDA			
Pisidiidae	-99		

Aquid Invertebrate Database Bench Sheet Report**Big Cr [14952], Station #4, Sample Date: 10/21/2014 4:25:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
"HYDRACARINA "			
Acarina	2		1
AMPHIPODA			
Hyaella azteca	1	33	2
BASOMMATOPHORA			
Lymnaeidae	1	1	
Menetus	1		
Physella			1
COLEOPTERA			
Berosus		1	
Dubiraphia		1	
Dytiscidae		1	
Helichus lithophilus	1	4	2
Peltodytes			1
Stenelmis	1		
DIPTERA			
Ablabesmyia	2	3	
Chironomidae	3	5	2
Chironomus	1		
Chrysops		1	
Corynoneura		2	1
Cricotopus/Orthocladius		1	13
Dicrotendipes			3
Diptera			1
Forcipomyiinae			1
Glyptotendipes	1		
Harnischia	1		
Hydrobaenus	2	2	3
Labrundinia		2	
Nanocladius		1	
Paralauterborniella	1		
Pilaria		1	
Polypedilum fallax grp			1
Polypedilum flavum	1	2	6
Polypedilum halterale grp	3	1	
Polypedilum illinoense grp	5	10	4
Polypedilum scalaenum grp			1
Rheotanytarsus	8	4	39
Simulium	7	8	9
Stelechomyia			1

Aquid Invertebrate Database Bench Sheet Report**Big Cr [14952], Station #4, Sample Date: 10/21/2014 4:25:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Stenochironomus			16
Stictochironomus	1		
Tanytarsus	3		1
Thienemanniella	1	9	4
Thienemannimyia grp.	5	31	9
Zavrelimyia		1	
EPHEMEROPTERA			
Acerpenna		5	1
Baetis	9	8	41
Caenis latipennis	99	127	13
Ephemerellidae			1
Fallceon	2	3	
Heptagenia	12	5	18
Isonychia			1
Leptophlebiidae	6	22	
Maccaffertium terminatum	13	11	5
Plauditus	1		
Pseudocloeon		3	
Stenacron	26	43	15
Stenonema femoratum	3		1
Tricorythodes	2	8	4
HEMIPTERA			
Belostoma		-99	
Corisella		-99	
Corixidae	1		
Neoplea			1
Ranatra fusca		-99	
Sigara		1	
Trichocorixa		1	
ODONATA			
Argia	1	9	
Basiaeschna janata		-99	
Enallagma	2		
Epithea (Epicordulia)		1	
Gomphus	9	3	
Ischnura		2	
Libellula		-99	
Macromia	7	2	
Progomphus obscurus	-99	-99	
PLECOPTERA			
Taeniopteryx	2		1

Aquid Invertebrate Database Bench Sheet Report**Big Cr [14952], Station #4, Sample Date: 10/21/2014 4:25:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
TRICHOPTERA			
Cheumatopsyche	6	6	38
Hydropsyche	1		
Nectopsyche	1	10	1
Nectopsyche diarina	4	5	2
Oecetis		1	
TUBIFICIDA			
Enchytraeidae	1		2
Tubificidae	3	5	4
VENEROIDA			
Pisidiidae		3	

Aquid Invertebrate Database Bench Sheet Report**Big Cr [14953], Station #5, Sample Date: 10/21/2014 5:30:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyaella azteca	3	23	7
COLEOPTERA			
Dineutus			-99
Dubiraphia	2	2	1
Helichus lithophilus		3	2
Macronychus glabratus			1
Peltodytes	3		
Stenelmis	4	1	1
DIPTERA			
Ablabesmyia		1	1
Ceratopogoninae	3		
Chrysops	-99		
Corynoneura	1	1	
Cricotopus/Orthocladus	1	1	2
Dicrotendipes			1
Glyptotendipes			1
Hydrobaenus	1	1	
Labrundinia		2	
Nanocladius	1	4	
Parachironomus			1
Paracladopelma	2	1	1
Polypedilum flavum	3	8	4
Polypedilum halterale grp	8		1
Polypedilum illinoense grp	3	1	2
Polypedilum scalaenum grp	2		2
Rheocricotopus			1
Rheotanytarsus	7	2	5
Simulium	1	4	4
Stenochironomus			15
Tanytarsus	2	1	2
Thienemannimyia grp.	4	20	12
Tipula		-99	
EPHEMEROPTERA			
Acerpenna		1	1
Baetis	1	5	27
Caenis latipennis	146	62	30
Centroptilum	1		
Fallceon		5	4
Heptagenia	12	24	42

Aquid Invertebrate Database Bench Sheet Report**Big Cr [14953], Station #5, Sample Date: 10/21/2014 5:30:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Isonychia rufa	1	2	1
Leptophlebiidae	1	10	1
Maccaffertium terminatum		6	6
Pseudocloeon		4	5
Stenacron	8	13	30
Stenonema femoratum	4	3	9
Tricorythodes	6	13	
HEMIPTERA			
Belostoma		-99	
Ranatra nigra	1		
Rhagovelia			4
Sigara	1		
LUMBRICINA			
Lumbricina		1	
MEGALOPTERA			
Sialis		-99	
ODONATA			
Argia	3	7	3
Enallagma	1	5	
Gomphidae	-99		
Ischnura			1
Macromia	-99		
Nasiaeschna pentacantha		-99	
Progomphus obscurus	2		
PLECOPTERA			
Taeniopteryx	3		1
TRICHOPTERA			
Cheumatopsyche	14	46	55
Hydropsyche	1	6	20
Nectopsyche	5	14	1
Nectopsyche diarina	10	22	2
Oecetis		2	
Ptilostomis		-99	
Triaenodes		2	
TUBIFICIDA			
Tubificidae	9	4	1

Aquid Invertebrate Database Bench Sheet Report**Big Cr [15093], Station #1, Sample Date: 3/18/2015 12:20:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
"HYDRACARINA "			
Acarina	1		2
AMPHIPODA			
Hyalella azteca	-99	3	
COLEOPTERA			
Peltodytes	-99		
Stenelmis			1
DIPTERA			
Ablabesmyia	14	2	1
Ceratopogonidae	4		
Chironomidae	4	4	
Cladotanytarsus	1		
Corynoneura		1	1
Cricotopus bicinctus	2	1	
Cricotopus/Orthocladius	40	81	124
Cryptochironomus	3		
Cryptotendipes	4		
Dicrotendipes	1		
Eukiefferiella			1
Hydrobaenus	26	4	6
Labrundinia	4	3	
Micropsectra		3	
Nanocladius	2		
Paracladopelma	3		
Paralauterborniella	17		
Paratanytarsus	6	5	
Phaenopsectra	2	1	
Polypedilum flavum		7	3
Polypedilum halterale grp	4		
Polypedilum illinoense grp	2	4	
Polypedilum scalaenum grp	16		
Rheocricotopus	1	16	3
Rheotanytarsus	12	24	5
Simulium		1	16
Stenochironomus			1
Tanytarsus	22	8	1
Thienemanniella	3	82	64
Thienemannimyia grp.	5	26	5
Zavrelimyia	3	3	
EPHEMEROPTERA			

Aquid Invertebrate Database Bench Sheet Report**Big Cr [15093], Station #1, Sample Date: 3/18/2015 12:20:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Baetis	1	1	1
Caenis	4		
Caenis latipennis	27	1	2
Heptagenia	6	7	5
Heptageniidae	3	1	2
Hexagenia	1		2
Leptophlebia	6	32	
Maccaffertium	7	2	
Stenacron		2	2
HEMIPTERA			
Corisella	1		
ODONATA			
Argia		4	
Calopteryx	-99		
Coenagrionidae	1		
Erpetogomphus	1	2	
Macromia	1	2	
Progomphus obscurus	1		
PLECOPTERA			
Taeniopteryx burksi		1	
RHYNCHOBDELLIDA			
Piscicolidae	-99		
TRICHOPTERA			
Cheumatopsyche	4	5	
Hydropsyche	4		4
Hydropsychidae	1	1	
Nectopsyche	2	6	1
Nectopsyche diarina	1		
TUBIFICIDA			
Limnodrilus hoffmeisteri		2	

Aquid Invertebrate Database Bench Sheet Report**Big Cr [15094], Station #2, Sample Date: 3/18/2015 2:10:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
"HYDRACARINA "			
Acarina	1	2	1
COLEOPTERA			
Dubiraphia		1	
Stenelmis	2	1	
DIPTERA			
Ablabesmyia	1	3	2
Ceratopogoninae	5		
Chironomidae	1		3
Cricotopus bicinctus		4	3
Cricotopus/Orthocladius	12	44	198
Cryptochironomus	1		
Cryptotendipes	1		
Dicrotendipes			1
Endochironomus			1
Eukiefferiella		1	3
Hydrobaenus	6	6	14
Nanocladius		1	
Paracladopelma	1		
Paralauterborniella	3		
Parametriocnemus			1
Paraphaenocladius		1	
Paratanytarsus		2	
Phaenopsectra			3
Polypedilum flavum	1	12	7
Polypedilum halterale grp	7		
Polypedilum illinoense grp		4	1
Polypedilum scalaenum grp	19	1	1
Rheocricotopus		21	14
Rheotanytarsus	5	12	3
Robackia	1		
Saetheria	1		1
Simulium		9	10
Stenochironomus			1
Tanytarsus		5	
Thienemanniella	4	58	46
Thienemannimyia grp.	5	25	15
Zavrelimyia	1	3	1
EPHEMEROPTERA			
Baetiscidae	1		

Aquid Invertebrate Database Bench Sheet Report**Big Cr [15094], Station #2, Sample Date: 3/18/2015 2:10:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Caenis latipennis	25	12	2
Heptagenia		17	7
Leptophlebia	1	28	3
Maccaffertium terminatum		11	3
Stenacron	2	7	2
Stenonema femoratum			1
HEMIPTERA			
Belostoma		-99	
ODONATA			
Argia		1	
PLECOPTERA			
Taeniopteryx		-99	1
RHYNCHOBDELLIDA			
Piscicolidae	3		1
TRICHOPTERA			
Cheumatopsyche	6	18	6
Hydropsyche	-99	2	
Nectopsyche	4	3	
Oecetis		2	
TUBIFICIDA			
Enchytraeidae		1	
Tubificidae	5	1	
VENEROIDA			
Pisidiidae		1	

Aquid Invertebrate Database Bench Sheet Report**Big Cr [15095], Station #3, Sample Date: 3/18/2015 3:25:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	1		1
AMPHIPODA			
Hyaella azteca	1	5	1
COLEOPTERA			
Dineutus			-99
Dubiraphia	1		
Gyrinus	1		
Helichus lithophilus	1		
Macronychus glabratus	1		
Neoporus		1	
Stenelmis	7		
DIPTERA			
Ablabesmyia	7	7	
Axarus	1		
Ceratopogoninae	7	3	1
Chironomidae	2		
Chrysops	1		
Corynoneura			1
Cricotopus bicinctus			1
Cricotopus/Orthocladius	17	56	65
Cryptochironomus	8	1	1
Dicrotendipes	1		3
Endochironomus	1		
Hydrobaenus	18	11	14
Labrundinia		1	
Micropsectra	2	5	
Nanocladius	4	6	1
Paracladopelma	1		
Parakiefferiella		2	1
Paralauterborniella	11	1	
Paraphaenocladius			1
Paratanytarsus	2	5	
Phaenopsectra		4	1
Polypedilum fallax grp			1
Polypedilum flavum	6		4
Polypedilum halterale grp	62	1	1
Polypedilum illinoense grp	1	6	6
Polypedilum scalaenum grp	16		1
Rheocricotopus	1	9	3

Aquid Invertebrate Database Bench Sheet Report**Big Cr [15095], Station #3, Sample Date: 3/18/2015 3:25:00 PM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Rheotanytarsus	10		1
Simulium	1	2	
Stenochironomus	1		10
Tanytarsus	3		2
Thienemanniella	1	18	9
Thienemannimyia grp.	5	21	5
Zavrelimyia	4	6	
EPHEMEROPTERA			
Acerpenna		1	
Caenis latipennis	30	1	
Heptagenia	3	3	1
Leptophlebia		65	
Stenacron	5	2	1
LUMBRICINA			
Lumbricina		2	
MEGALOPTERA			
Sialis	1		
ODONATA			
Argia	6	20	
Calopteryx		1	
Gomphidae	2		
Gomphus		-99	
Libellula		1	
Macromia	1		
PLECOPTERA			
Taeniopteryx			1
RHYNCHOBDELLIDA			
Piscicolidae	2	1	
TRICHOPTERA			
Cheumatopsyche	3	6	
Hydropsyche			1
Nectopsyche	2	26	
Oecetis		1	
Polycentropus	1		
Pycnopsyche		-99	
TUBIFICIDA			
Enchytraeidae	2	1	1
Limnodrilus claparedianus	3	5	
Limnodrilus hoffmeisteri	2	14	
Tubificidae	39	27	

Aquid Invertebrate Database Bench Sheet Report

Big Cr [15095], Station #3, Sample Date: 3/18/2015 3:25:00 PM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
VENEROIDA			
Pisidiidae		4	

Aquid Invertebrate Database Bench Sheet Report

Big Cr [15096], Station #4, Sample Date: 3/19/2015 9:05:00 AM

NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA "			
Acarina	1		
AMPHIPODA			
Hyaella azteca		1	
ARHYNCHOBDELLIDA			
Erpobdellidae		-99	
BASOMMATOPHORA			
Physella		1	
COLEOPTERA			
Dubiraphia	1		
Macronychus glabratus			1
Peltodytes	1		
Stenelmis		2	1
DIPTERA			
Ablabesmyia	2	1	
Ceratopogoninae	3		
Chironomidae		5	6
Chironomus	1	1	1
Cladotanytarsus	1		
Corynoneura		3	1
Cricotopus bicinctus		2	
Cricotopus/Orthocladius	2	77	194
Cryptochironomus	1		
Dicrotendipes		1	
Ephydriidae	1		
Eukiefferiella		1	4
Hydrobaenus	6	12	22
Labrundinia		1	
Micropsectra		7	2
Nanocladius		12	2
Parakiefferiella		2	
Paralauterborniella	2		
Paraphaenocladius		5	1
Paratanytarsus	1	3	1
Paratendipes	1		
Pericoma	4		
Phaenopsectra	1		1
Polypedilum flavum	2	10	5
Polypedilum halterale grp	13		
Polypedilum illinoense grp	1	13	1

Aquid Invertebrate Database Bench Sheet Report**Big Cr [15096], Station #4, Sample Date: 3/19/2015 9:05:00 AM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Polypedilum scalaenum grp	3	2	
Rheocricotopus		6	4
Rheotanytarsus	1	31	8
Saetheria	3		
Simulium	4	6	9
Stenochironomus			1
Tanytarsus		7	2
Thienemanniella		22	37
Thienemannimyia grp.	2	13	8
EPHEMEROPTERA			
Acerpenna		2	1
Caenis latipennis	5	10	3
Heptagenia	2	9	1
Leptophlebia	9	21	7
Stenacron	4		3
Stenonema femoratum			1
LUMBRICINA			
Lumbricina		-99	
ODONATA			
Argia		4	
Gomphus	1		
Progomphus obscurus	1		
RHYNCHOBDELLIDA			
Piscicolidae	1		
TRICHOPTERA			
Cheumatopsyche		5	1
Nectopsyche diarina		10	1
TUBIFICIDA			
Enchytraeidae	5		1
Limnodrilus hoffmeisteri	1	1	
Tubificidae	29	4	1

Aquid Invertebrate Database Bench Sheet Report**Big Cr [15097], Station #5, Sample Date: 3/19/2015 10:35:00 AM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyaella azteca	2	3	
COLEOPTERA			
Berosus		1	
Dineutus	-99		
Helichus lithophilus		4	
Peltodytes	2		
Scirtidae	1		
Stenelmis	2		
DIPTERA			
Ablabesmyia	7	5	
Ceratopogoninae	2		
Chironomidae	11	13	3
Chironomus	3		
Chrysops		1	
Corynoneura			2
Cricotopus sylvestris grp	1		
Cricotopus/Orthocladius	22	94	163
Cryptochironomus	5		
Dicrotendipes			1
Hydrobaenus	32	9	13
Labrundinia	2	2	
Limnophyes		1	
Micropsectra	2	3	3
Nanocladius	1	7	
Paralauterborniella	7		
Paraphaenocladius		1	
Paratanytarsus	1	1	
Paratendipes	26		
Phaenopsectra	1		1
Polypedilum flavum	1	7	10
Polypedilum halterale grp	68		1
Polypedilum illinoense grp		1	1
Polypedilum scalaenum grp	20		
Polypedilum tritum	1		
Rheocricotopus	2	3	4
Rheotanytarsus	6	33	13
Saetheria			3
Simuliidae			1
Simulium	1	8	33

Aquid Invertebrate Database Bench Sheet Report**Big Cr [15097], Station #5, Sample Date: 3/19/2015 10:35:00 AM****NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence**

ORDER: TAXA	NF	RM	SG
Stenochironomus	1		1
Tanytarsus	2	2	
Thienemanniella	5	44	29
Thienemannimyia grp.	4	12	10
Tribelos	1		
Zavrelimyia	1	1	
EPHEMEROPTERA			
Caenis	3	3	
Caenis latipennis	35	3	4
Heptagenia	3	13	3
Heptageniidae	1	5	1
Isonychia		1	
Leptophlebia	22	17	5
Maccaffertium	2		
Stenacron		1	
ODONATA			
Argia	1	5	2
Calopteryx		1	
Erpetogomphus	1		
Macromia	1		
Progomphus obscurus	1		
RHYNCHOBDELLIDA			
Piscicolidae	2		
TRICHOPTERA			
Cheumatopsyche		5	6
Hydropsyche		-99	1
Hydropsychidae			2
Nectopsyche		11	
Oecetis		2	
UNIONIDA			
Unionidae		-99	